



BLS-to-ADF Transition System

- Motivation
- Design
- Implementation
- Schedule

This presentation is the result of effort from the following individuals:

Mark Adams, John Anderson, Mario Camuyrano, Dan Edmunds, Hal Evans, John Fogelsong, Johnny Green, Marvin Johnson, Shoua Moua, Alan Stone, Nikos Varelas



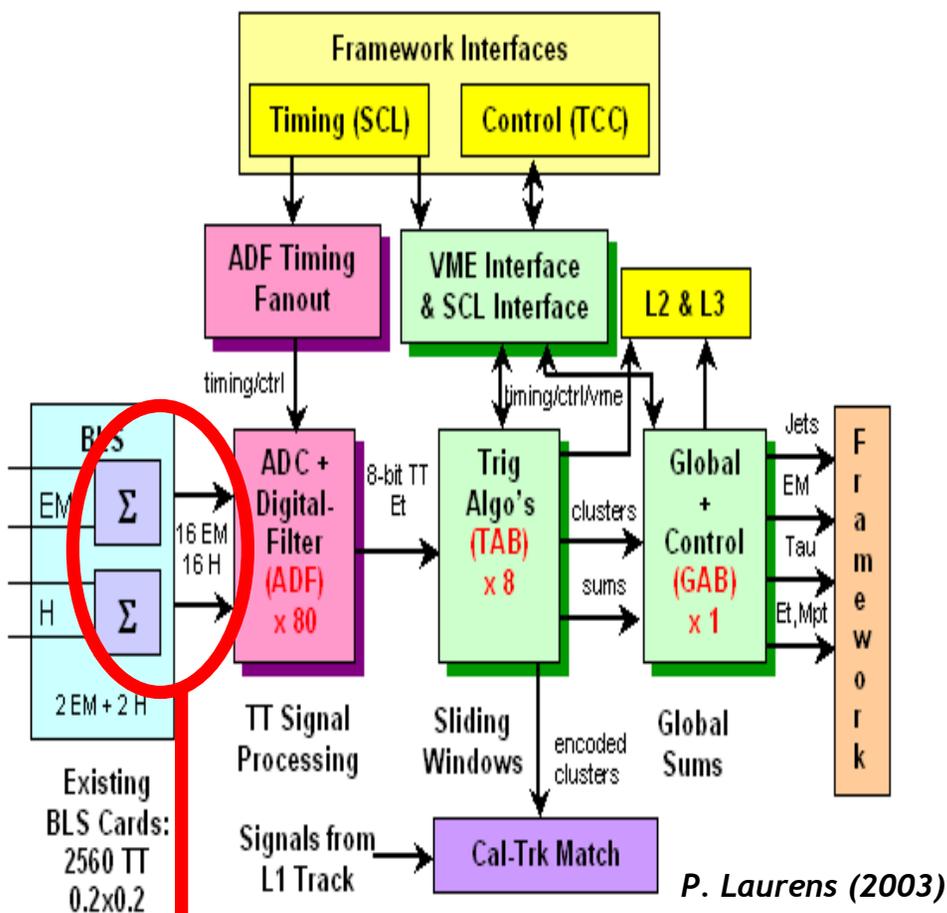


L1 CAL Trigger Signal

- The trigger pickoff of the Calorimeter signal takes place on the Baseline Subtactor (BLS) cards on the platform
 - There are 1280 BLS cards each with up to 48 channels of physics readout : $2 \eta \times 2 \phi \times 12$ depth (EM & Hadronic layers)
 - Each of the 1280 Trigger Towers (TT) has a differential EM and Hadronic component (EM+,EM-,HD+,HD-)
 - The trigger eta & phi has a factor of two larger granulation than the precision readout (physics) eta and phi
 - The TT signal is then carried along four consecutive coaxial cables to the first floor of the Moveable Counting House (MCH1) and distributed among ten racks (M103-M112)
 - Each rack receives as inputs TT cables from all phi for a consecutive group of eta (1:4, -1:4, 5-8...)
- All of this refers to the Run I (and existing) L1 CAL trigger



Motivation for Transition System



How do we get the signals from the existing cables to the new electronics?

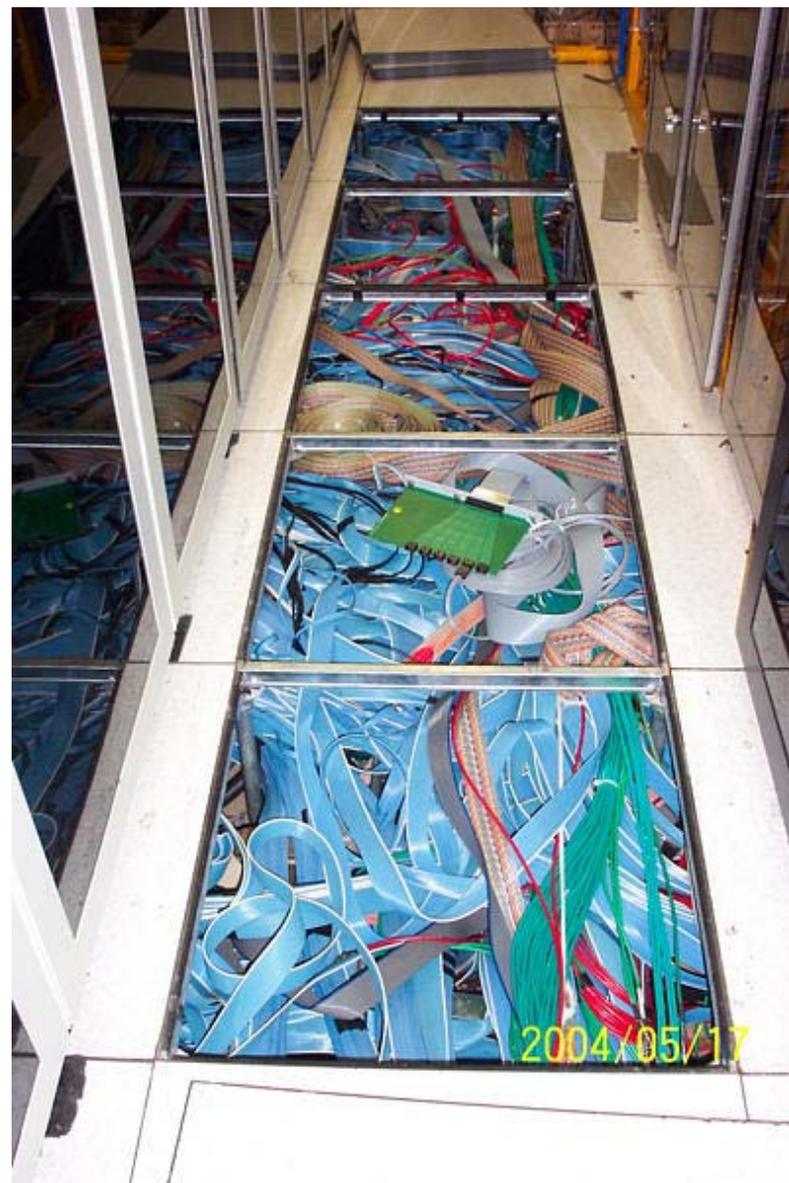
- The BLS trigger cables will be reused for the upgrade
 - Cannot replace or reroute them!
- New electronics are more compact
 - 4 crates (new) vs 20 crates (old)
- Connector mismatch
 - Cannot plug 8-pin BLS connectors directly into 20-pin ADF connectors (on backplane)
- Cable access & channel debugging
 - Plug in scope during physics data taking without disconnecting cables
 - Disentangle problems pre- and post-ADF crates
- Preserve signal integrity
 - Noise, reflection, timing, etc. are all concerns
- Build & test independently
 - We do not need the ADF or TAB systems



BLS Trigger Cables



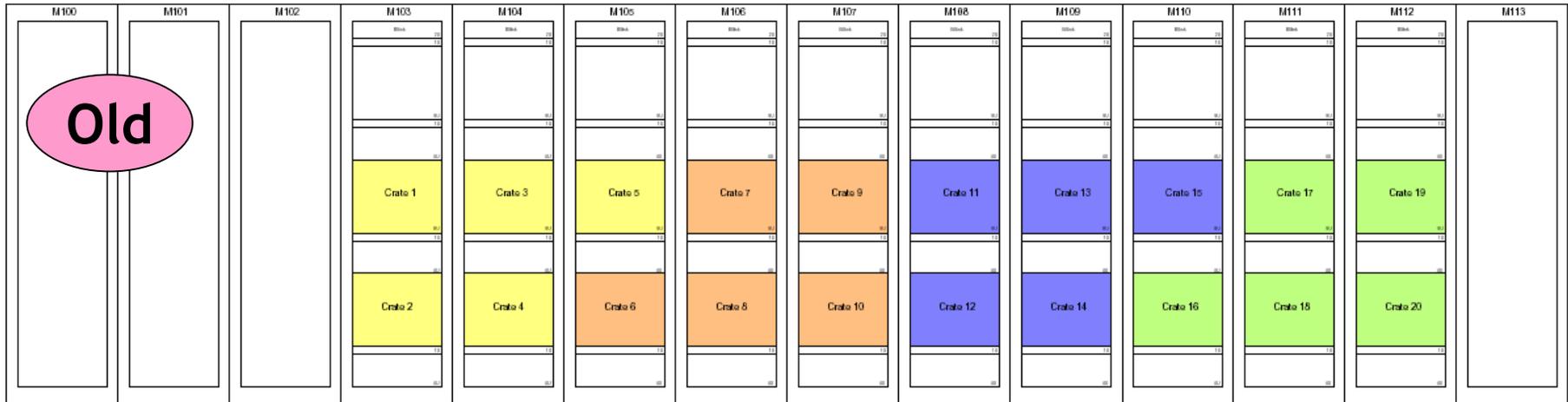
- 78 & 80 Ohm impedance
 - Two different manufacturers
 - Installed at the beginning of Run I
- 130 feet to North End-Cap Calorimeter [EC]
- 150 feet to Central Calorimeter [CC]
- 180 feet to South End-Cap Calorimeter [EC]
- Congested space beneath floor boards





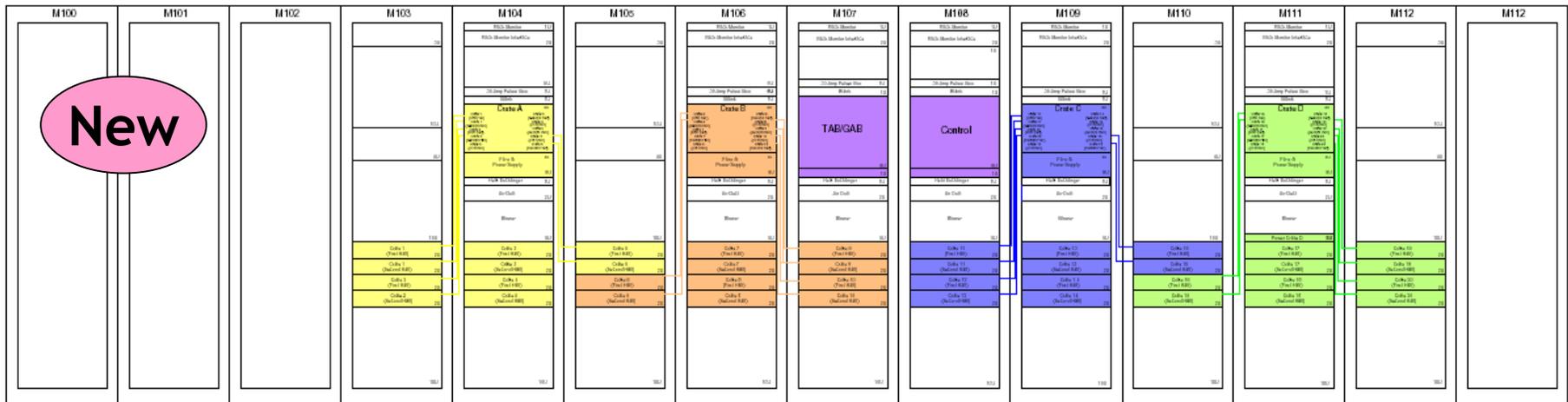
MCH Configuration

L1 Cal Tracking MCH1 Rack Assignments
(Old Configuration)



Color coding illustrates the old & new TT readout.

L1 Cal Tracking MCH1 Rack Assignments
(New Configuration)

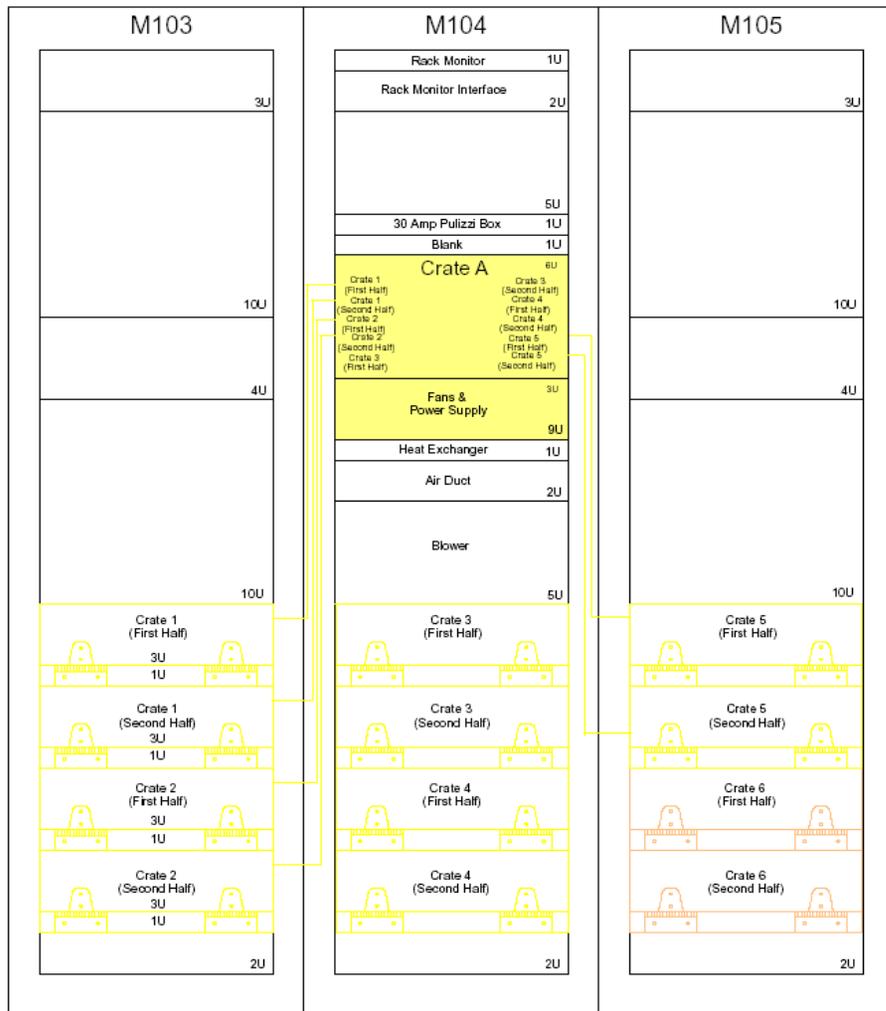


John Fogelsong
18 Aug 2004

J. Fogelsong (2004)



MCH Rack (x10)



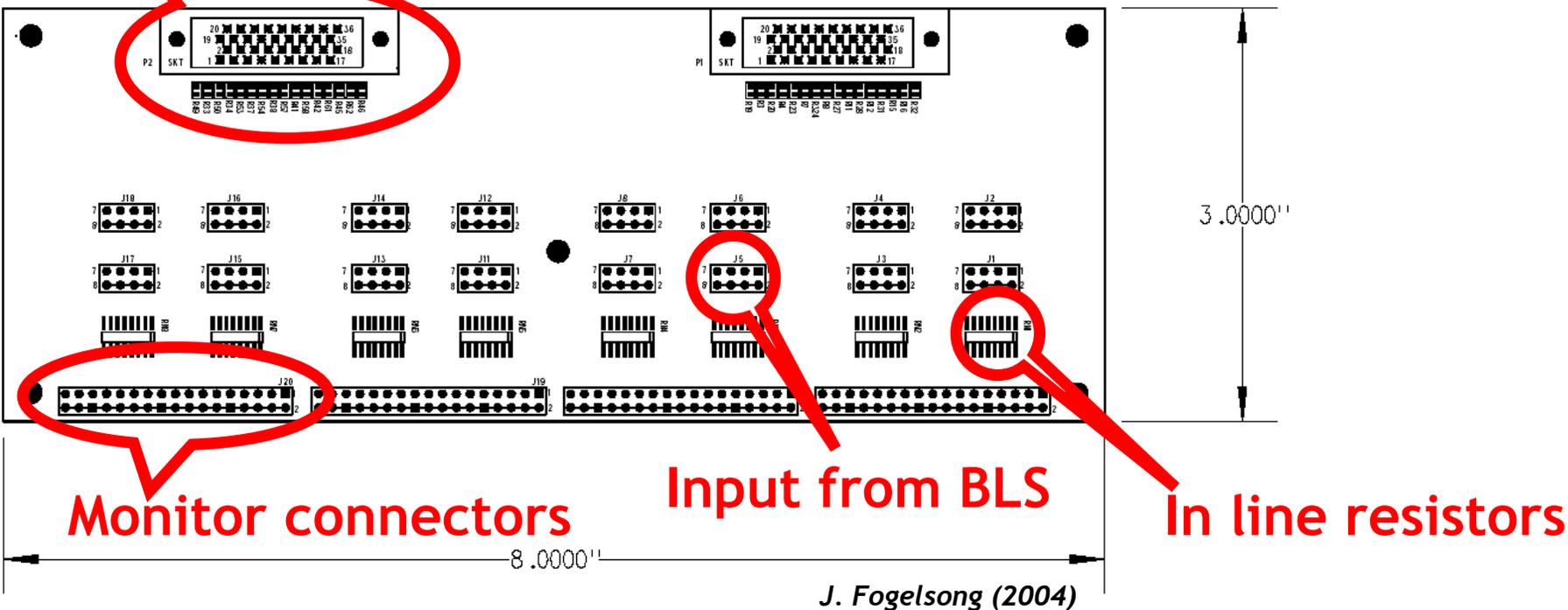
J. Fogelsong (2004)

- Within each rack, there are 128 TT cables
 - We have pursued a design which does not require rerouting the BLS cables
- Four patch panels per rack
 - Passive electronics
 - Input: 32 TT cables/patch panel
 - Output: 2 ADF boards
- Protection System and Cooling
 - 6 of 10 racks
 - 4 racks contain only patch panels
 - Rack Monitor, RMI, Remote controlled Pulizzi Box, Smoke & Drip Detectors
 - Blower, Heat Exchanger & Fan
- Plan on reusing racks as well
 - Strip out racks to frames
 - BLS cables are routed externally among cable guides
 - Will only need to disconnect cables from boards



Patch Panel Card (x80)

Output to ADF (Pleated Foil Cables)



Two patch panel cards - stuffed printed circuit boards - mounted to each patch panel. Only the monitor connectors are visible from the front of the patch panel. Cables are connected from the back.

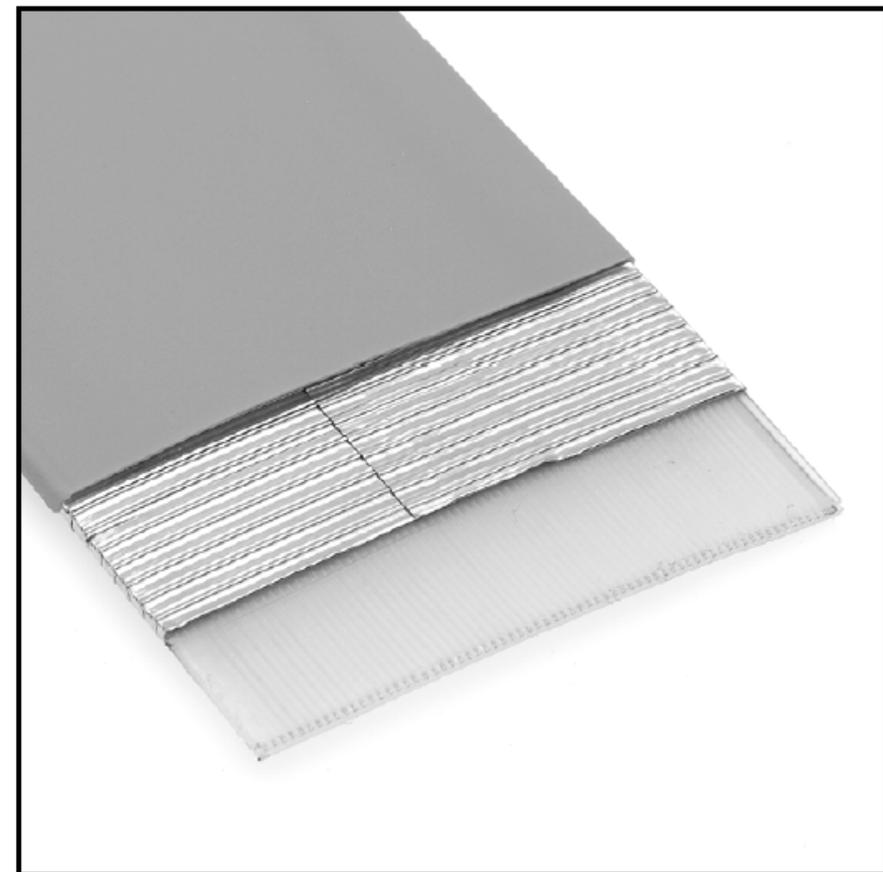


Pleated Foil Cable (x160)

3M™ Pleated Foil Shielded Cable

.025" 30 AWG Solid, TPE Primary, TPE Cover

90211 Series



- Can be used with IDC mass termination connectors
- Can be used in applications requiring standard impedance of 75 ohms single ended
- Extremely low crosstalk, used in the all signal mode to quadruple signal density as compared to standard .050 inch flat ribbon cable
- Perfect for board-to-board applications within electronic equipment, TPE cover prevents pleated copper foil from accidental shorting
- Solid pleated copper foil provides flexibility and 35 db average shielding effectiveness

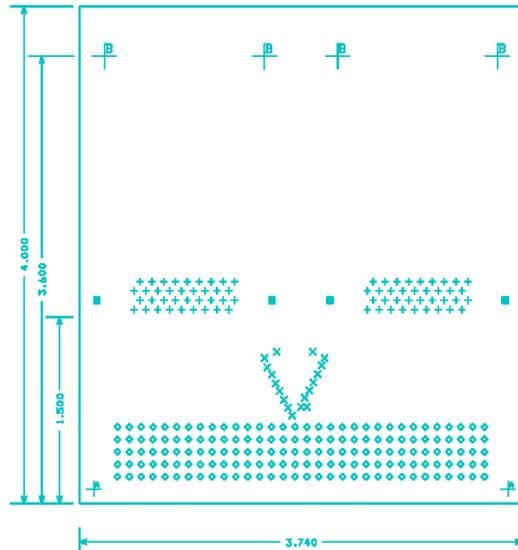
Date Modified: May 30, 2003

TS-0598-08
Sheet 1 of 2

Good impedance match to BLS trigger cables. Need two pleated foil cables to carry TT signals from each patch panel card to the ADF board.

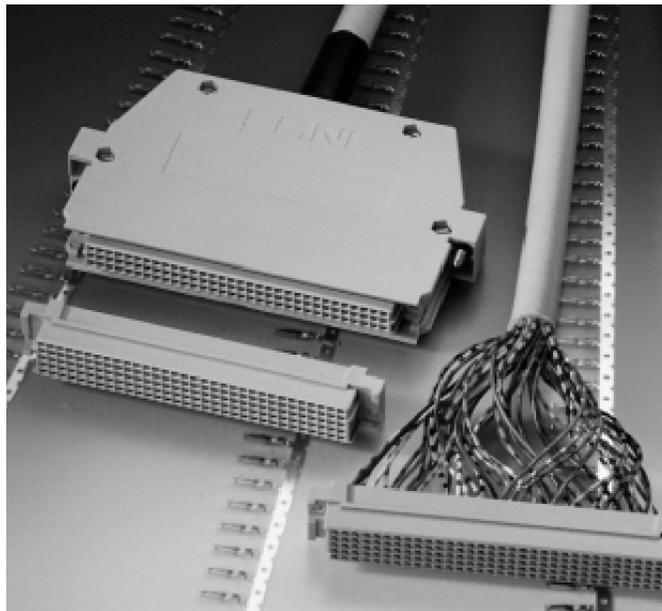


Paddle Card (x80)



- ERNI connector mates to ADF backplane - 20 paddle cards per ADF crate

- Paddle card receives two inputs from pleated foil cables



This is a general layout, but may not be the final layout.
Connector P2 Viewed looking from the back of the backplane(back of crate).

	D E	C D	B C	A B	Z A
1		Ch_00_EM_P	VME_5V	Ch_00_HD_P	
2		Ch_00_EM_N	GND_PLANE	Ch_00_HD_N	VME_64_GND
3		Ch_04_EM_P		Ch_04_HD_P	
4		Ch_04_EM_N		Ch_04_HD_N	VME_64_GND
5		Ch_08_EM_P		Ch_08_HD_P	
6		Ch_08_EM_N		Ch_08_HD_N	VME_64_GND
7		Ch_12_EM_P		Ch_12_HD_P	
8		Ch_12_EM_N		Ch_12_HD_N	VME_64_GND
9		Ch_01_EM_P		Ch_01_HD_P	
10		Ch_01_EM_N		Ch_01_HD_N	VME_64_GND
11		Ch_05_EM_P		Ch_05_HD_P	
12		Ch_05_EM_N	GND_PLANE	Ch_05_HD_N	VME_64_GND
13		Ch_09_EM_P	VME_5V	Ch_09_HD_P	
14		Ch_09_EM_N		Ch_09_HD_N	VME_64_GND
15		Ch_13_EM_P		Ch_13_HD_P	
16		Ch_13_EM_N		Ch_13_HD_N	VME_64_GND
17		Ch_02_EM_P		Ch_02_HD_P	
18		Ch_02_EM_N		Ch_02_HD_N	VME_64_GND
19		Ch_06_EM_P		Ch_06_HD_P	
20		Ch_06_EM_N		Ch_06_HD_N	VME_64_GND
21		Ch_10_EM_P		Ch_10_HD_P	
22		Ch_10_EM_N	GND_PLANE	Ch_10_HD_N	VME_64_GND
23		Ch_14_EM_P		Ch_14_HD_P	
24		Ch_14_EM_N		Ch_14_HD_N	VME_64_GND
25		Ch_03_EM_P		Ch_03_HD_P	
26		Ch_03_EM_N		Ch_03_HD_N	VME_64_GND
27		Ch_07_EM_P		Ch_07_HD_P	
28		Ch_07_EM_N		Ch_07_HD_N	VME_64_GND
29		Ch_11_EM_P		Ch_11_HD_P	
30		Ch_11_EM_N		Ch_11_HD_N	VME_64_GND
31		Ch_15_EM_P	GND_PLANE	Ch_15_HD_P	
32	GND_PLANE	Ch_15_EM_N	VME_5V	Ch_15_HD_N	VME_64_GND

Note:

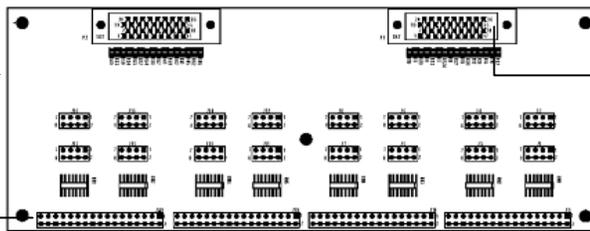
- 1) If 16 signals(1 ribbon) are grouped together, then four pleated foil cable assemblies are required for each paddle card.
- 2) If 32 signals(2 ribbons) are grouped together, then two pleated foil cable assemblies are required for each paddle card.



Review of Signal Path

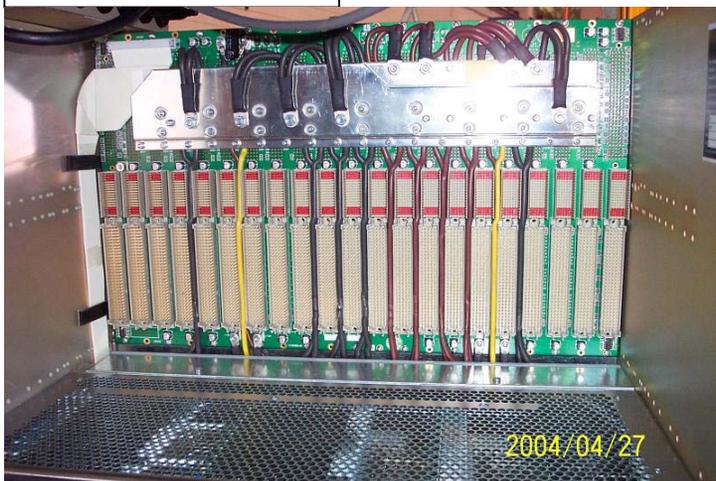


Patch Panel Card (2 per Patch Panel)
16 BLS trigger cable inputs
2 Pleated Foil Cable outputs to one Paddle Card



Scope

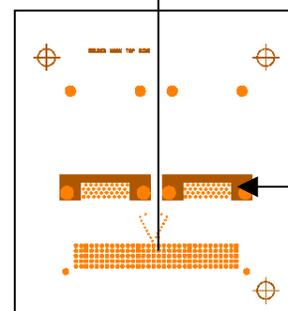
ADF Backplane



3M Pleated Foil Cables



Paddle Card (1:1 to ADF cards)
2 Pleated Foil Cables inputs from one Patch Panel Card
One ERNI connector output to the ADF backplane



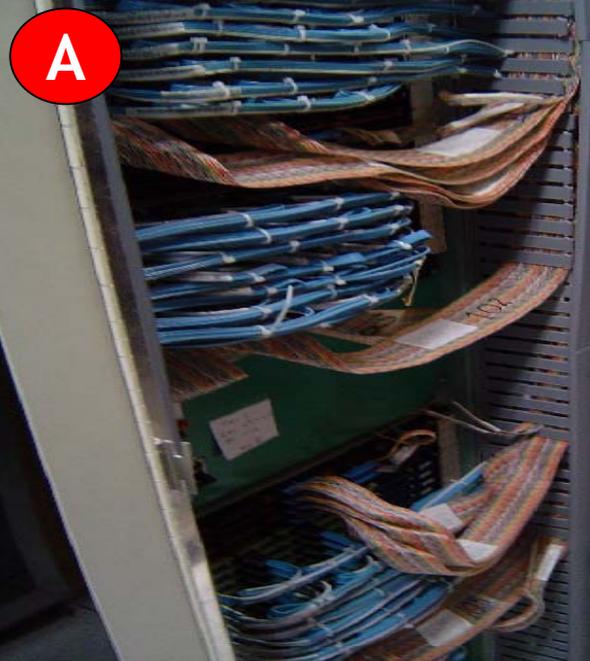


The Cost & Prototypes

- Primary components to the BLS-to-ADF Transition System
 - Pleated Foil Cables x160
 - Patch Panels x40
 - Patch Panel Cards x80
 - Paddle Cards x80
- Johnny Green worked up an estimate in late July
 - \$35,000 + 10%
 - File is linked from my web page
- Building a 5% system for prototyping and testing
 - 2 Patch Panels
 - 8 + 1 Pleated Foil Cables
 - Completed.
 - 4 + 2 Patch Panel & Paddle Cards
 - Circuitry done. Being stuffed this week at Fermilab.
 - Will it work?



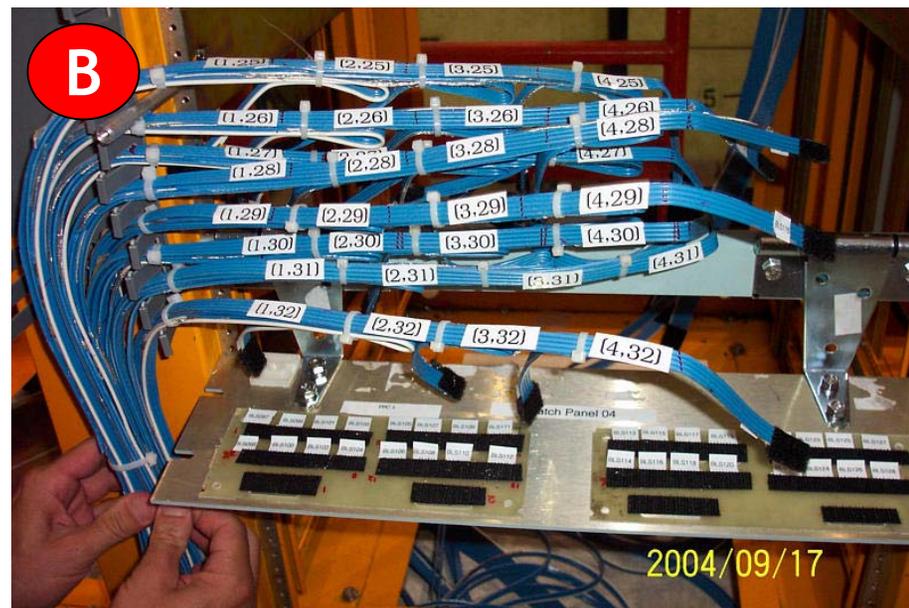
Mock-up



Making a mock-up of existing BLS trigger cables as similar as possible.

- A wise man advised me that most problems with cabling are mechanical not electrical
 - Strain relief & volume flow
 - Connectorization
 - Labelling
- Take the time now to figure out how to go from **A** to **B**
 - We won't have the luxury of time next year

- This is not easy!
 - We are on our 4th iteration, but we are converging
- Validating Mario's channel map
 - Better to find mistakes now
- Will write up a procedure





Signal & Impedance Matching Tests

- We want to test how the transition system will modify the BLS signal
 - Pulse generator
 - Limited set of trigger cables from splitter boards
 - Preamp pulser, cosmics, real physics?
- Impedance matching
 - Can add resistors on each board to correct impedance differences
- Signal integrity
 - Inserting a signal with the same shape of the BLS signal
 - Measuring the attenuation for 1 to 20 MHz
- What about noise?
- Need to complete mock-up and signal tests before signing off on full scale production of boards, panels and cables



My L1 CAL Web Page



Run IIB L1CAL

Questions, comments and requests should be sent to the Alan L. Stone
Last modified: Thu Sep 9 07:01:05 CDT 2004

BLS-ADF Transition System	Labels	Racks, Crates & Cables	L2	Photos	Archives
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- Alan Stone UIC
- Dan Edmunds MSU
- Hal Evans
- Fermilab PPD/EED**
- Run IIB Trigger Upgrade
- Agenda Server
- List Server
- Runs & Stores
- Run II Luminosity

BLS-ADF Transition System

- 2004-09-08: The [Pulizzi model PC975](#) is being considered as the box for AC distribution and control for the active racks with an ADF, TAB/GAB or Control crate. We will need six of them for MCH1.
- 2004-09-08: Johnny Green will look for a vendor to make self-laminating labels needed for the [pleated foil cables](#) (160 x 2) and [BLS trigger cables](#) (1280 x 1). Each text file has three columns - Label Name, Origin and Destination - extracted from the [master Excel spreadsheet](#) produced by Mario Camuyrano. In Powerpoint, I made a slide with the [pleated foil cable label schematic](#) drawn to scale.
- 2004-09-07: [Requisition order](#) from Pentaplex Printed Circuits for additional for 6 each of the patch panel card and paddle card prototypes.
- 2004-09-02: [Notes from a BLS-to-ADF Transition System meeting](#). The layouts from George Wolf for the [Patch Panel Card](#) and [Paddle Card](#) were reviewed.
- 2004-09-01: [Email from Hal Evans](#) to provide the [TAB/GAB power usage](#).
- 2004-08-23: The requisition was approved to get an outside contractor (George Wolf) to finish the layout of the patch panel card and the paddle card. We were losing manpower because of the current shutdown, so relying on D0 technicians would have delayed the schedule. The revised artwork should come back by Aug 31.
- 2004-08-16: [Power output](#) from the ADF and VME Control crates provided by Dan Edmunds.
- 2004-08-12: Nine pleated foil cables have arrived and passed Johnny Green's inspection. They are about 9.5 feet instead of 10 as they were shortened to reconnecterize.
- 2004-08-06: Email discussion on [rack power needs](#) for the new L1 CAL trigger.
- 2004-08-05: [Answers on grounding issues](#) for the patch panel and paddle card from Dan Edmunds.
 - 2004-08-10: [Response from John Anderson](#).
 - 2004-08-10: Speaking with Dan on the phone - the 10k ohm resistor for the monitoring effectively removes all signal components faster than 1 micro-second. Dan proposes using a 500 ohm resistor instead.
- 2004-08-04: Discussions between Alan Stone, Mario Camuyrano and John Fogelsong to clarify the relationship between the channel spreadsheet and the engineering schematics. Mario has agreed to revise his Excel spreadsheet to include the following for each of the 1280 BLS trigger cable inputs:
 - New MCH1 Rack (103-112)
 - Patch panel bulkhead (1-40)
 - Patch panel card (1-80 or 1A,1B...40A,40B)

Engineering Schematics

- [Patch Panel](#) - Bulkhead for BLS input, pleated foil output (to paddle board) and test points.
- [Block Wiring](#) - All signal and ground lines for 16 trigger towers from BLS cable to patch panel to pleated foil to paddle card to ERNI connector to ADF backplane.
- [Patch Panel Card](#) - Input from sixteen BLS trigger connectors, and output to two pleated foil connectors. There are also four monitor connectors to which an expert can plug in a scope.
- [Paddle Card](#) - Input from two pleated foil connectors, and output to ADF backplane via ERNI connector.
- [MCH1 Rack Layout](#) - Distribution of patch panels and crates for the new trigger system. The color coding illustrates which part of the old trigger system reduces to which ADF crate.

Other Diagrams

- [Trigger Control Path](#)

Frequent updates. Links to many documents. Notes from meetings.



Schedule & Summary

- Open question - Reuse racks or replace racks?
 - We are going with a design that can handle either scenario
 - Reusing racks will likely take more time (first estimate: ~6 weeks)
 - Also irreversible - strip racks of components in an unpretty way
 - Cables will only need to be unplugged
 - not rerouted, pulled beneath the floor, or some other risky scheme
 - We should be able to delay this decision until we know more precisely when the 2005 shutdown begins AND how long it will be
- Another week on the cable & patch panel mock-up
 - Working closely with John Fogelsong
- 2-3 weeks on signal testing
 - Involve Dan Edmunds for consultation and advanced study
- Hope to sign off on everything by the end of October for full scale production
 - Pleated foil cables have longest lag time (about six weeks)
 - Boards, connectors, misc parts are mostly stock items
 - Line tracing & board stuffing takes about a week
 - Develop a quality control procedure
- Safety & Cooling system components being procured
 - Pulizzi boxes, smoke detectors, rack monitors
- Assistance is welcome on the mock-up, signal tests and/or quality control